

## STUDIES IN NEARCTIC DESERT SAND DUNE ORTHOPTERA

A new Genus and Species of Stenopelmatine Crickets from the Kelso Dunes with notes on its multi-annual life history and key. Part X

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During the past decade the author has made a score of trips to the great Kelso Dunes studying its fauna and flora: the summers of 1957-1960 assisted by National Science Foundation grants. As these dunes lie 155 miles north of Indio, California, by road, a total of 6200 miles has been travelled in these trips during the period 1954-1964. On the second trip in mid June, 1955, tracking a strange trail by day led to the discovery of a crippled Jerusalem sand cricket. Due to its great rarity, only a few specimens have been taken during the years. Often years go by without the finding of a specimen, especially true of the drouth years which most have been since 1960. The second specimen was a young nymph, captured the night of October 25, 1957, when a light drizzle of rain was falling on the dunes.

The discovery of specimens was somewhat expedited, when, in the spring of 1959, I started teaching Extension Courses for San Diego State College. One of the requirements for my course NATURE STUDY OF THE DESERT was an overnight field trip to the Kelso Dunes, usually held in late April and late October of every year. With 25 to 50 teachers, accompanied often by many children and quite a few Coleman lanterns, such a group of searchers covers an area far greater than any scientist can possibly do. Even with such groups, only a few specimens have been found through the years. The last finding was five young nymphs, the night of April 20, 1963, when the sands were icy cold (temperature of the sand next morning at 7:00 was 34° Fahrenheit). At the time of writing in August, 1965, almost two and one half years later, three are still alive and are about one-half to two-thirds grown, so that we may expect the multi-annual life cycle to run three or possibly four or more years in length.

In a paper soon to be published by the California Academy of Sciences, the author has laid the groundwork for future studies in the genus *Stenopelmatus* Burmeister. From this research it is obvious that the worker must rely on the chaetotaxy of the legs as the most significant taxonomic feature to distinguish the various species. In this article, I recognized and redescribed *S. intermedius* Davis and Smith along chaetotaxical lines. Such nebulous characters as punctuation, length of antennal segments, nature of frontal sutures and the sternal plates have been discarded, along with the form of the ovipositor, which appears identical in all species. I have laid the stress on the spination of the legs.

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Hence, if a certain species shows a marked departure from the normal spination characteristic of the genus *Stenopelmatus*, then that creature must be accorded new generic rank. This I have done with the Kelso Jerusalem Sand Cricket and this consideration has been arrived at after years of thoughtful weighing of the problem. The Provisional Key presented below will amply illustrate the difference between the genus *Stenopelmatus* and the new genus based on chaetotaxical taxonomy.

#### PROVISIONAL KEY TO CALIFORNIAN STENOPELMATINE CRICKETS

1. Tibial spines vestigial or missing on the apical dorsal margins of the caudal tibiae. Ringlet of 6 apical caudal calcars almost even and broadly spathulate for arenicolous habitus. Median or presubapical spur on the ventral surface of the foretibiae absent. Pronotum not expanding anteriorly. Size medium, coloration uniformly orangish ..... *Ammopelmatus* new genus
- Tibial spines prominently developed on the apical dorsal margins of the caudal tibiae. Ringlet of 6 apical caudal calcars uneven in length, usually conical or subconical in form, the innermost calcar the longest. Median or presubapical spur on the ventral surface of the foretibiae always present. Pronotum expanding anteriorly to house the posterior portions of the very large head. Size medium to very large; coloration generally dark, especially on abdomen ..... *Stenopelmatus* (2)
2. Size large; color of head and pronotum orange red ..... 3
- Size medium to small; color of head and pronotum not orange red but piceus to shining black ..... 4
3. Calcars of the caudal tibiae forming a semi-ringlet of 6 long spurs, the two innermost much the longest and cylindrical in form ..... *longispina* Brunner
- Calcars of the caudal tibiae forming a semi-ringlet of 6 spurs, these spathulate or trowel-shaped on their inner faces, the three inner relatively equal and longer than the 3 outer spurs ..... *fuscus* Haldeman
4. Entire body uniformly dark brown with black abdominal tergites. Caudal tibiae with 5 internal and 2 external apical dorsal teeth ..... *intermedius* Davis & Smith
- Upper half of head shining black with tan sutural areas, Pronotum with dorsum bearing irregular areas of shining black. Femora marked with pale brown fasciations. Caudal tibiae with 3 to 4 internal and 2 external apical dorsal teeth ..... *pictus* Scudder

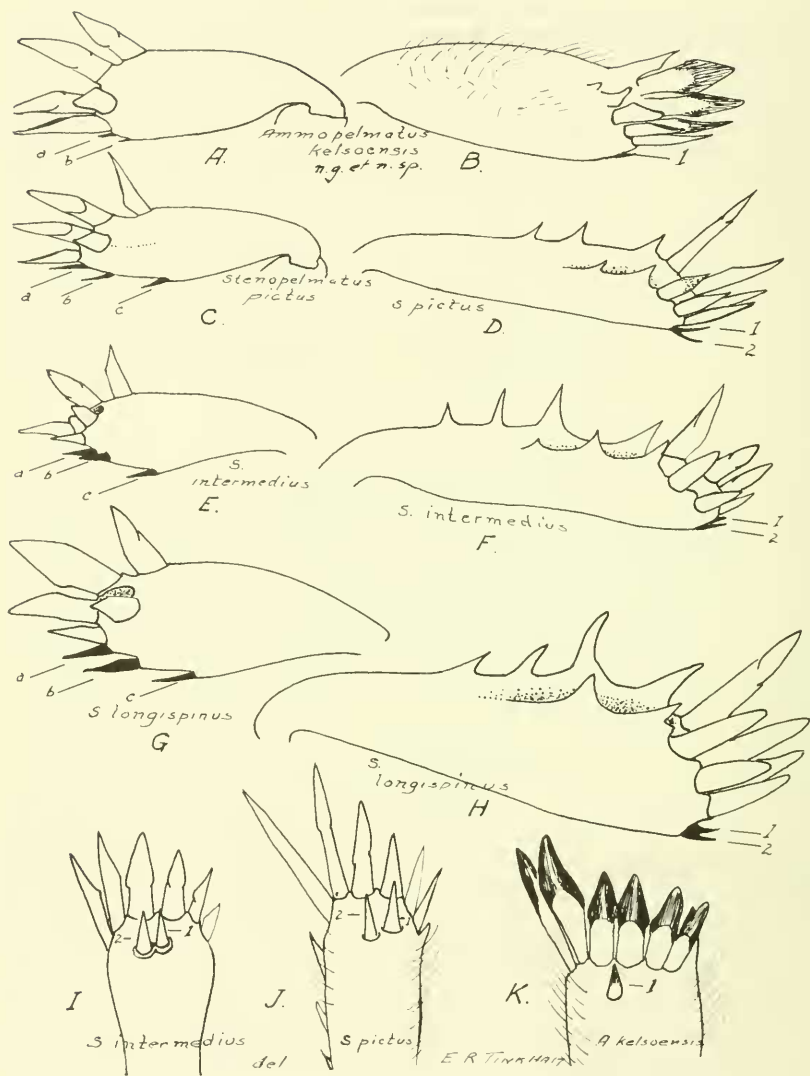
*Ammopelmatus* Tinkham, new genus

GENERIC DIAGNOSIS: Size medium, uniformly pale yellowish orange on head and pronotum; abdomen more whitish orange with

the infuscated annular rings on the dorsum of the abdominal segments less conspicuous than observed in *Stenopelmatus*. The general features are those of a medium-sized *Stenopelmatus*, from which it is amply distinct in many features. Form more slender than in *Stenopelmatus*, the cephalic features generally similar but lacking the typical megacephalism portrayed by *Stenopelmatus*, nor does the anterior portions of the pronotum seem to house the posterior margin of the enlarged head as in *Stenopelmatus*. The pronotum is relatively narrower in *Ammopelmatus* and the posterior angles of the dorsum of the pronotum more evenly and broadly rounded than in *Stenopelmatus*, where this angle has a slight flattening on this latero-posterior face. Anterior lateral angle of the lateral lobes of the pronotum more evenly rounded in *Ammopelmatus* than in *Stenopelmatus*, where all species have a pronounced downward angulation. Sternal plates in the new genus are similar to those observed in *Stenopelmatus*.

*Ammopelmatus* shows several distinctive generic categories in the spination of chaetotaxy of the legs which quickly separates it from *Stenopelmatus*. These are chiefly found in the apical and sub-apical tooth-like spurs found on the ventral side of the tibiae. In *Ammopelmatus*, the ventral margin of the fore tibiae have only one or two very small spurs placed one behind the other (See A of plate), whereas the various species of *Stenopelmatus* have always three larger ones placed in linear alignment, the third or most posterior of which being almost median in placement. The mesotibiae are alike in both genera, there being only an evenly placed pair of apical conical spurs. Likewise, in the caudal tibiae in *Stenopelmatus*, there is always a pair of apical conical spurs on the ventral surface (see D, F, H, I and J of plate), whereas in *Ammopelmatus* there is only one centrally placed apical ventral spur (see B and K of plate); a feature of considerable generic worth. Thus the two features: single apical ventral spur of the caudal tibiae and the two apical small spurs placed in linear alignment on the ventral side of the fore tibiae, quickly identify *Ammopelmatus*, the new genus. In addition the six short spathulate calcars of the caudal tibiae and the lack of large teeth on the dorsal margins of the caudal tibiae, as well as the truncate or spathulate nature of the apical dorsal teeth of the caudal tibiae, further identifies *Ammopelmatus*. Other features, such as the ovipositor and supra-anal and subgenital plate, appear to be similar to that in *Stenopelmatus*.

The diagnostic characteristics peculiar to the new genus *Ammopelmatus* have apparently been developed through the ages by adaptation to an arenicolous or ammophilous environment. The loss of all tibial teeth on the dorsal margins of the caudal tibiae, except for the anal ones which have developed into a pair whose posterior surface has developed a truncate spathulate face, appears to be a direct response to a sand habitat. The broadening, shortening and evening of the calcars of the caudal tibiae is, likewise, a development for excavation of sand and a sort of pushing forward movement along



## EXPLANATION OF PLATE

All drawings of fore tibiae are of left fore tibiae, external face; drawings of caudal tibiae are left caudal tibiae external face. All drawings much enlarged and then reduced.

*Ammopelmatus kelsoensis* from Kelso Dunes, A. fore tibiae showing only 2 ventral apical teeth (a and b). B. Caudal tibiae showing 1 ventral apical tooth (1).

*Stenopelmatus pictus* from Antioch, California, C. fore tibiae showing 2 apical (a and b) and 1 subapical ventral tooth (c). D. Caudal tibiae showing dorsal tibial spines, calcars (1 to 6) and pair of ventral apical teeth (1 and 2).

*Stenopelmatus intermedius* from Lagunitas, California. E. fore tibiae showing calcars and 2 apical (a and b) and 1 subapical ventral tooth (c). F. Caudal tibiae showing dorsal tibial spines, calcars (1-6) and pair of ventral apical teeth (1 and 2).

*Stenopelmatus longispina* from Palo Alto, California. G. fore tibiae showing calcars, 2 apical and 1 subapical teeth. H. caudal tibiae showing dorsal teeth, calcars and two apical ventral teeth.

I. Ventral view of caudal tibiae of *S. intermedius* showing the pair of apical teeth and the six calcars.

J. Ventral view of *S. pictus* showing apical pair of teeth and the six calcars.

K. Ventral view of caudal tibiae of *Ammopelmatus kelsoensis* showing single apical tooth and the spatulate calcars.

the loose surface of the sand of the magnificent mountainous ridges of sand known as the Kelso dunes.

GENOTYPE: *Ammopelmatus kelsoensis*, new species

Having studied the life of the sand dunes of the three great North American Deserts since 1952, and four years, 1957-1960, under grant from the National Science Foundation, it would appear that *Ammopelmatus* is restricted to the Kelso Dunes.

*Ammopelmatus kelsoensis* Tinkham, new species

ALLOTYPE FEMALE: Kelso Dunes, San Bernardino County, California, April 27, 1963, Ernest R. Tinkham. Type deposited in the Tinkham Eremological Collection.

DESCRIPTION: Head typical of the *Stenopelmatus* crickets, the eyes more narrowly pyriform than in *Stenopelmatus*, otherwise closely similar in all general features of the head to that genus. Pronotum more evenly quadrate than in *Stenopelmatus*, the lateral margins parallel to the very broadly rounding posterior lateral angles; posterior margin squarely truncate, anterior margin evenly and conspicuously emarginate with that margin typically hirsute. Dorsum of the pronotum crossed by a conspicuous groove or sulcus about one-sixth the pronotal length caudad of the anterior margin and parallel to it, with a median sulcus commencing on the shoulders and angling forward and downwards to the emargination on the anterior third of the lateral lobes of the pronotum; the lobe in front of this emargination more evenly rounding into the anterior margin of the pronotum than in *Stenopelmatus*, where it is more angularly produced downwards. Sternal plates similar to those observed in *Stenopelmatus*. Supra-anal plate semicircularly rounded; subgenital plate very broadly triangular; ovipositor typical of *Stenopelmatus*.

Leg spination as follows: forelegs with enlarged femora smooth, the dorsal margin quite arcuately rounded; tibiae with 5 typical calcars surrounding the apical margin (see A of plate) and

with only two ventral apical conical spurs in linear alignment; tarsi quadrimerous, the first segment equal to the remaining three in length. Meso legs with mesofemora more slender than fore femora and less arcuate along the dorsal margin; meso tibiae with five terminal calcaria, each dorsal margin bearing a subapical toothlike spur proximad of each lateral calcar; tarsi as in the forelegs, the first segment giving evidence that it is formed of two fused segments. Caudal legs with caudal femora short and heavier than in *Stenopelmatus*, the inferior margin straight, the superior or dorsal margin strongly arched with both dorsal margins bearing long brown setae; caudal tibiae more tumid than in *Stenopelmatus*, the external and internal dorsal margins without teeth except for a large spathulate tooth at the internal apex and a smaller similar tooth on the external apex, the latter having a minute tooth just proximad of it and both margins lined with long brown setae. Ventral surface with only one apical spur of generic import. The caudal tibiae bear apically the 6 spathulate calcaria so typical of the new genus (see figs. B and K of plate). Caudal tarsi similar to those in the fore and middle legs, except that the first segment is slightly longer.

Caliper measurements in mms.: body length 31.0; pronotum 5.8 long by 7.5 in width; caudal femora 9.0 x 3.2; caudal tibiae 8.8 x 2.2; ovipositor 2.0 mms.

PARATYPES: 12 females from the same habitat as the Allotype at the Kelso Dunes, 1 female adult, 1 subadult, Oct. 25, 1957, the latter living until July 15, 1960, 1 adult June 14, 1957, 1 adult Oct. 21, 1961, 5 small female nymphs April 20, 1963, 3 adults April 27, 1963. Two of April 20, 1963, females still alive and subadult on Sept. 7, 1965.

Paratypes identical to the Allotype except for variations in the ventral apical spur of fore tibiae and caudal tibiae. Oct. 25, 1957, 1 adult and 1 subadult, have one extra ventral apical spur on caudal tibiae. One Oct. 20, 1963 female and one April 27, 1963 paratype possess only single spurs ventrally on the fore tibiae and caudal tibiae. One paratype from Oct. 20, 1963, has one spur on fore tibiae but two spurs on caudal tibiae.

Range in measurements of adult paratypes: body length 29.0—31.0; pronotum 5.0 x 7.3—5.8 x 7.5; caudal femore 8.8 x 3.1 x 9.0 x 3.2; caudal tibiae 8.7 x 2.2 x 8.8 x 2.2; ovipositor 2.2 — 2.0 mms.

#### DATE OF NIGHT COLLECTING TRIPS

1954: June 25; 1955: June 15; 1956: July 13; 1957: June 14, June 30, Oct. 25; 1958: April 19, June 10, July 1, Sept. 22; 1959: March 27, April 9, May 9, May 22, Oct. 17; 1960: April 30, Oct. 19; 1961: April 15, Oct. 21; 1962: April 28, Oct. 20; 1963: April 20, 27, Oct. 21; 1964: May 2, Oct. 24.

From 1959 on, all April and October night collecting was assisted by 25 to 50 teachers with Coleman lanterns and flashlights.



## COLLECTING NOTES

- 1955: June 15. one crippled adult crawling across dunes in early morning.
- 1957: June 14: 1 small nymph, 1 adult. Air and sand temp. 20°C.  
Oct. 25. light drizzle on the dunes commencing about 5 p.m.  
1 small nymph, 1 adult.
- 1961: Oct. 21 adult, temp. 25°C.
- 1963: April 20. 5 young nymphs collected between 8-9 p.m. when air temp. 13.2°C and sand surface 13.0°C. Rained and sleeted during night. At 7:00 a.m., air 6.0°C and sand in shade 2.0°C.  
April 27. 8-10 p.m. 3 adults. Air and sand surface were 11°C.

HABITAT: *Ammopelmatus* has been found only in a limited area at the north base of a sand declivity, some 15 to 25 feet high, that lies about 200 yards southwest of the main camping area and about 1½ miles ENE of the main peak of sand that is about 700 feet high. In this area there are scattered clumps of Sandpaper weed, *Petalonyx Thurberi*, Croton, *Croton californicum*, Sand dune grass, *Oryzopsis hymenoides*, and in wetter years a great variety of other plants such as *Dicoria canescens*, *Euphorbia* spp., *Astragalus* sp. and many others.

ORTHOPTERAN ASSOCIATES: Nocturnal associates on the sands include: *Macrobaenetes kelsoensis* Tinkham 1962, *Ammobaenetes*, n.sp., the sand roach *Arenivaga*, sp., *Ceuthophilus fossor* and in the creosote growing from the sands in the marginal area close by such detritids as: *Anoplodusa arizonensis*, *Capnobotes fuliginosus*, *Eremopedes* n.sp., as well as the Creosote leaf katydid *Insara corvilleae*. Diurnal associates include: *Coniana snowi* on its host *Coldenia plicata*, *Xeracris minimum* on *Petalonyx Thurberi*, the ever present *Trimerotropis p. pallidipennis*, *Ligurotettix c. kunzei* on Creosote stems, *Tanaocerus k. koebeli* on marginal *Franseris dumosa*, *Parabacillus coloradus* on the common Galleta grass *Hilaria rigida* and the ground mantid *Litaneutria minor*.

FAUNAL DESIGNATION: As camp on the Kelso Dunes lies about 2550 feet elevation, the Kelso Dunes lies entirely within the confines of the Gila Desert which is characterized chiefly by vast mesas and bajadas of Creosote.

## LIFE HISTORY STUDIES

EGG: The egg of *Ammopelmatus kelsoensis* is roundly oval, pearly white in coloration and measures 5.2 mms. in length by 3.3 mms. in maximum diameter. Only one egg has been found in captivity during the decade; partly due to the fact that the rearing has been mainly of nymphs.

**NYMPHAL STAGES:** The small nymph collected the night of Oct. 25, 1957, lived until mid-July, 1960, when it died during my absence on a trip back east. No record of moltings was obtained.

The cold night of April 20, 1963, when temperatures dropped to 37°F., 5 small nymphs were found immobile on the sand. These were given Numbers 1 to 5, and fed lettuce nightly, but it was not always possible, due to my great preoccupation with other duties to screen the sand as often as it should have been screened. Consequently some molts can be expressed only as "early" or "late" in a particular month while others were observed in the act of molting. As the eggs of *Macrobaenetes* Tinkham and *Ammoboenetes* Hubbell hatch in late September or early October with the advent of the first rains, as do other forms of desert insect life, and as the nymphs have been found in the fall, all evidence indicates that these five young nymphs had hatched in the fall of 1962. As such they were either first stadium nymphs or possibly some that were a little larger may have been in the second stadium.

The salient features of each will be given below followed by a short summary of the life history of the new genus and species.

No. 1:

1963: April 20: small nymph collected  
late June; molted, small pieces of exuvium found July 4.  
chewing up of cast skin occurs some days after molt  
Aug. 5: found pieces of complete molt.  
Sept.: molt in late Sept.  
Oct.: molted night of Oct. 16-17

1964: Sept. molted in late September.

1965: Aug.: molted in early part of month.  
Sept.: still living at time of writing manuscript.

No. 2:

1963: April 20: small nymph collected  
July 4: found complete exuvium  
Sept.: molted night of Sept. 2-3  
Oct.: molted night of Oct. 20-21

1964: summer: molted but time not known  
Oct.: molted between Oct. 20 and Oct. 30

1965: Sept.: died on fourth, was molting Sept. 2 but failed to get out of exuvium; tried to remove creature from old skin but failed to survive.

No. 3:

1963: April 20: collected small nymph  
June: found complete skin in late June



Sept.: late, found parts of 2 legs

Dec.: 13, found parts of body, 1 leg, parts of palpus

1964: Aug.: died on the third

No. 4:

1963: April 20: collected small nymph

June: molted in late June

Aug.: molted on 3rd

Sept.: 25: found lying on side at 10:30 p.m., having just molted. Temp. 28°C (82.4°F). Sept. 28 only part of cast skin remained after feeding on it.

Oct. 29: found feeding on freshly molted exuvium

1964: July: died

No. 5:

1963: April 20, collected small nymph

June: molted in late June

Aug.: found pieces of abdomen, front and coudal tibiae indicating molt in early August.

Nov.: molted at 10:30 p.m. 19-20th. Exuvium at head end of freshly molted cricket

1964: Sept. 14, molted, lying on side. Sleeping upside down on 17th at noon.

1965: Sept.: 18, found lying on back at 10:30 p.m. with cast skin.

**LIFE HISTORY SUMMARY:** As far as is known the egg hatches in the early part of the fall; probably having been laid the previous spring. Whether there is a molt in the fall or early spring is not known at the present time. The first known molt is in late June or very early July; Second molt in late July or very early August, usually; Third molt usually in late September or up until late October. The Fourth molt occurs in the summer of the second year and the Fifth molt about September of that same year. The Sixth molt happens about early September of the third year from the evidence at hand. It is believed that adults maturing in September of the third year live through to the following spring when the eggs will be laid, thus giving a life span from egg to egg laying of four years.

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